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Minimizing the cost of integrating DG and incentives for localisation of DG investments in networks

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Improvement of the Social Optimal Outcome of Market Integration of DG/RES

in European Electricity Markets

Minimizing the cost of integrating DG and incentives for localisation of DG investments in networks

CEPS/ECN/IMPROGRES Workshop
The future of EU electricity grids:
Who will benefit from smart grids and at what costs?

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Intelligent Energy Europe

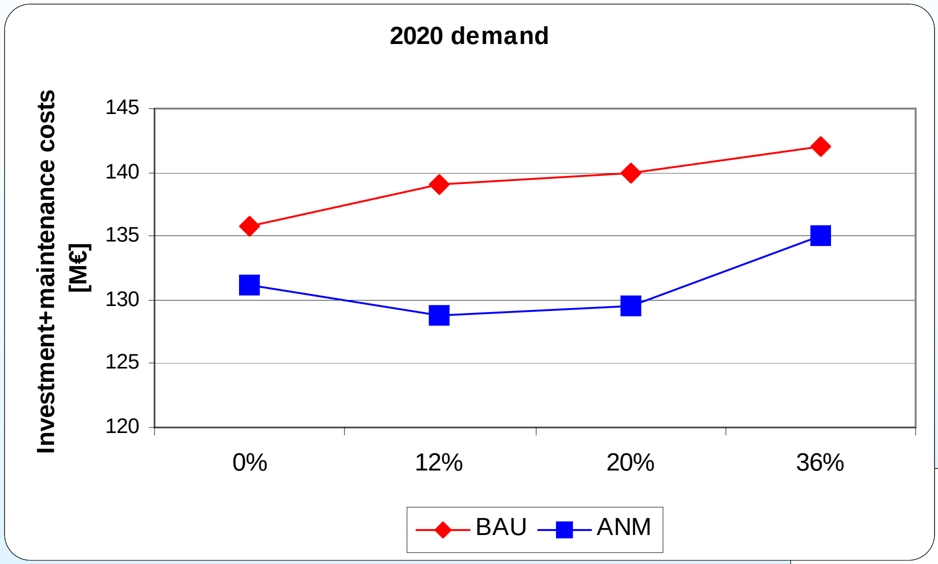
What have we done?

- Quantified the costs of connecting DG:
  - BAU: Passive behaviour of demand and DG
  - ANM: Demand response and generation control
- Three actual distribution areas: Netherlands, Germany and Spain
  - Several scenarios of demand (2) and DG penetration (4)
  - Two snapshots per scenario: maximum net demand and maximum net generation
- Reference Network Models:
  - Large-scale distribution planning models (regulatory use)
  - Results independent from actual network conditions

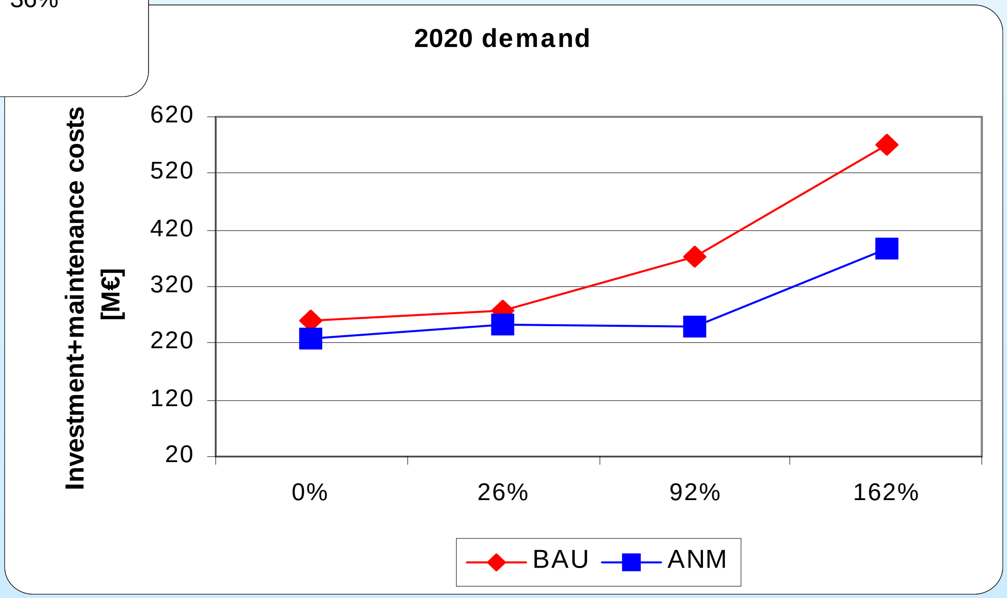
Distribution areas studied

- **Kop van Noord Holland (Netherlands):** Sub-urban, rural area. 80000 loads, 675km^2. Large penetration levels of wind and CHP (DG production can surpass peak demand).
  - Response options considered comprise shifting lighting demand of greenhouses, limited wind curtailment and controlling CHP production.
- **Mannheim (Germany):** Urban area. 6100 loads, 20km^2. Connection of roof PV and micro-CHP. PV production may surpass the maximum instantaneous consumption at LV level.
  - Response options considered: LV demand response was unattractive. Hence, DG maximum production reduced by 20%.
- **Aranjuez (Spain):** Sub-urban, industrial area. 61600 loads, 3400km^2. Few wind and CHP units (HV) and PV farms (MV).
  - Response options: LV demand response and changes in CHP and PV production patterns by active control and a shift in peak demand time

Results

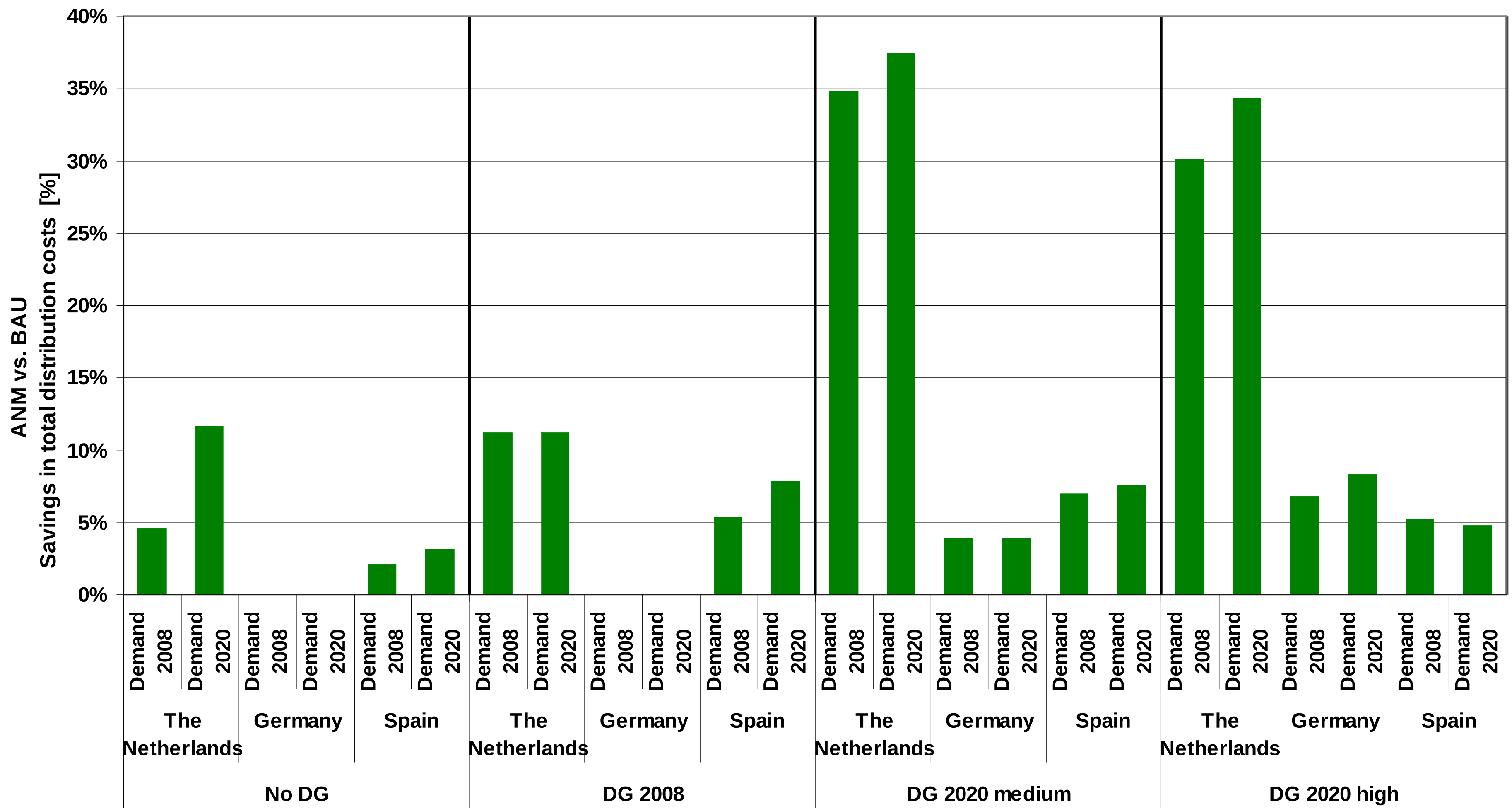


Spanish case study (left): a reduction in network costs is obtained with moderate DG penetration levels. This is due to the lower capacity needs caused by DG production at peak load periods



Dutch case study (right): network costs increase with DG, albeit much less than under a BAU. Main savings correspond to transformation capacity due to a reduction in maximum DG production

Results



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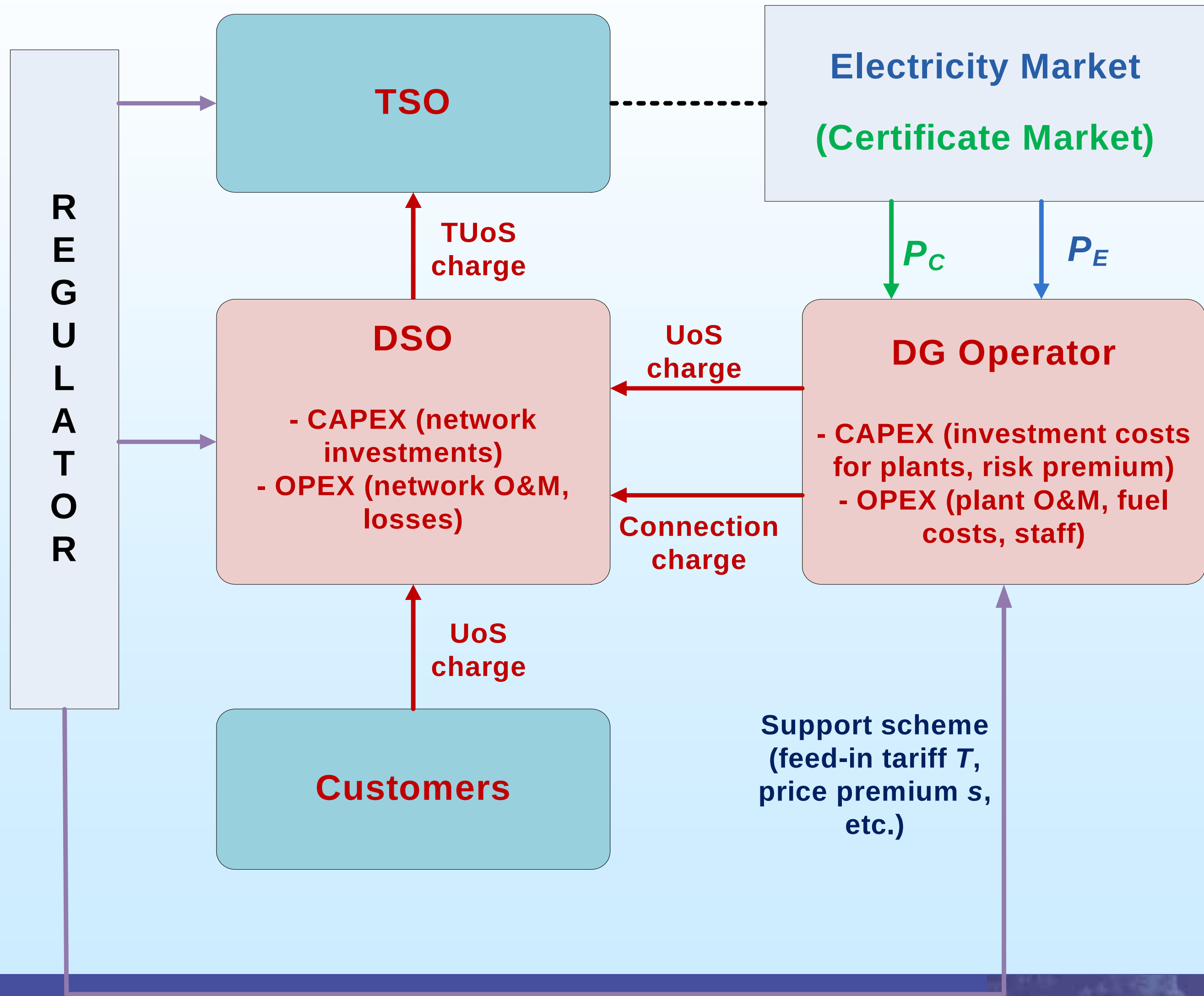
Conclusions

- DG can cause distribution network costs to rise in spite of advanced response options. Moderate penetration levels can reduce them
- However, DG integration costs can be reduced through ANM (savings from 2% to 35% as compared to BAU)
- Results significantly differ on an area basis. Higher savings if:
  - Distribution area characteristics: geographical (higher density) and temporal integration of DG and loads
  - BAU planning assumptions: conservative ("fit-and-forget")
  - Type and degree of response options: higher controllability
- In some places, ANM is the only (maybe temporarily) alternative due to barriers to the construction of new network assets
- ANM requires a throughout cost-benefit analysis. The IMPROGRES project provides a first estimate (reports will be available soon).

Interactions and revenue effects



Characteristics of interactions between regulation and incentives

- Distributed generation is embedded in the present regulatory framework and market structure
  - large variation in support and regulatory approach among countries exists
  - main revenue impact from support *level*
- Promoting efficient DG localization under different types of network regulation and support scheme is essential

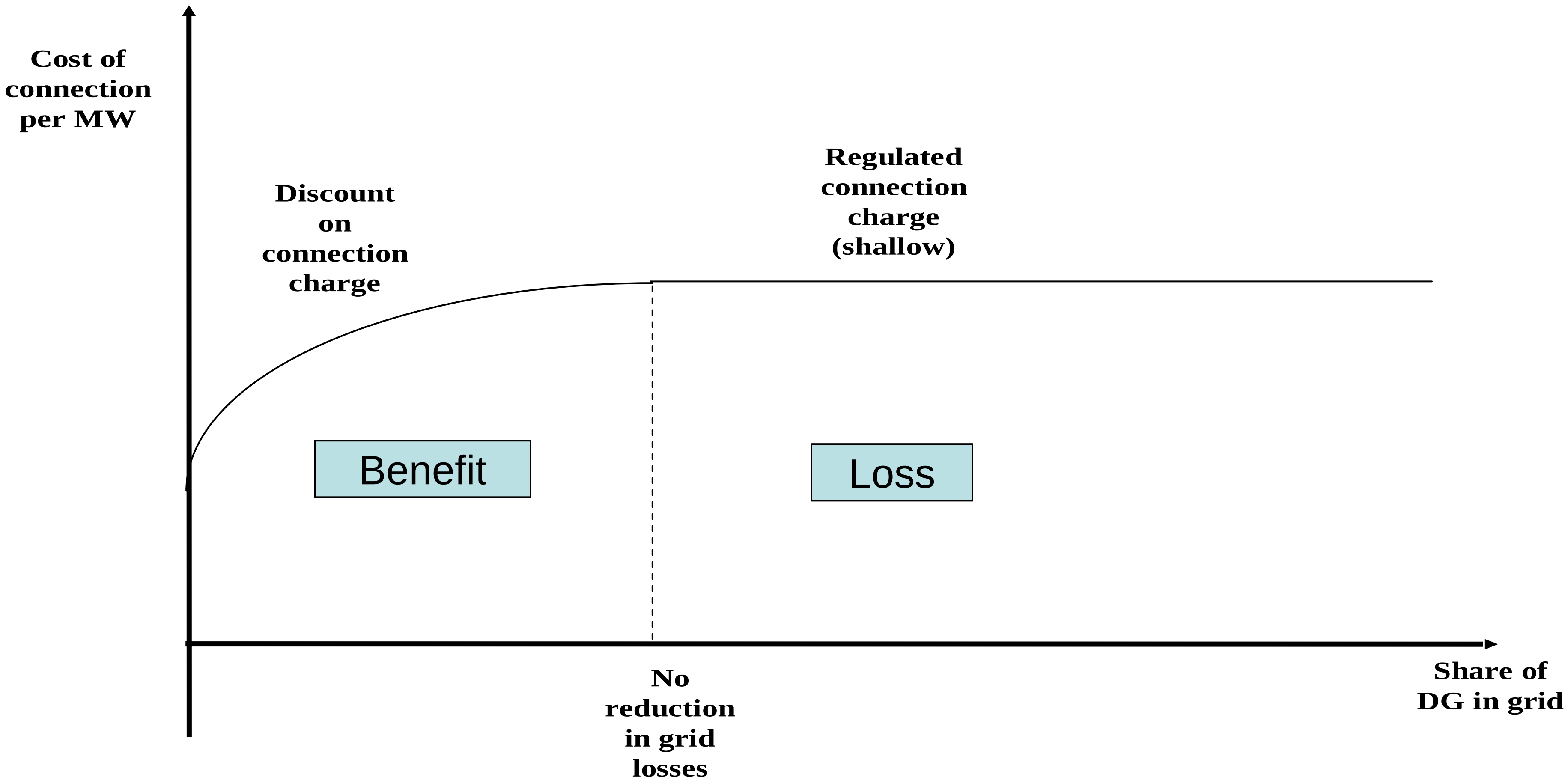
Efficient DG localization

- Localization within market (price area) does not depend on support scheme
- Localization within a market primarily depends on generation potentials (wind conditions)
- Secondly localization depends on connection charges and UoS charges
  - shallow connection charges provide transparent and low costs to DG investment
  - to cover the remaining integration costs of DG, UoS charges for DG generators should be considered

Connection charges and DSO regulation?

- DSO should be allowed to retain the profits from reduced grid losses and from deferred investments
- DSO should be regulated to charge a transparent maximum connection charge for DG (shallow)
  - and allowed to reduce this connection charge if DG generation will provide benefit to the grid e.g. reduced losses or reduced/deferred network investments
- DSO UoS charges for DG generators could support
  - more equal share of network integration costs between consumers and generators and between consumers in different grids (more similar UoS charges for consumers)
  - the possibility to encourage DG investment to take place at low cost locations in the grid by reducing connection charges

Grid losses and efficient DG localisation



Concluding remarks

- Efficient market integration is facilitated with market based support schemes, but the effect on distribution grids is small
- Efficient location within market is accomplished with DSO providing incentives for DG to invest where integration costs are the lowest
- Allowing average UoS charges also for DG generators could make it possible for the DSO to provide investment incentives (connection charge discounts) in grids with low integration costs and at cost reducing locations in grid

Thank you very much

For further information please visit:

http://www.improgres.org/